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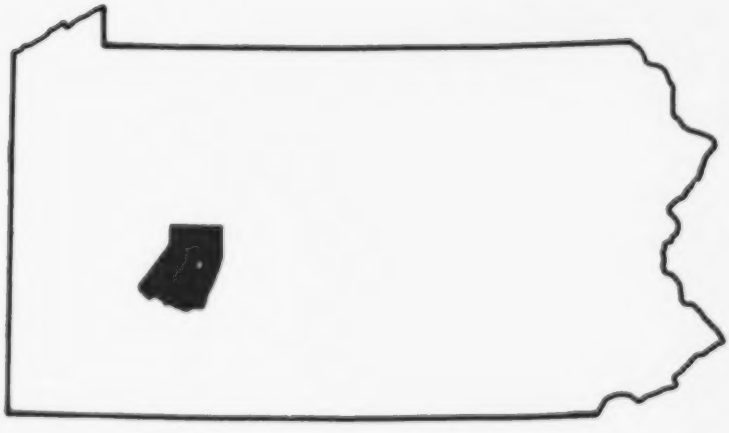
FLOOD INSURANCE STUDY

TOWNSHIP OF ARMSTRONG, PENNSYLVANIA
INDIANA COUNTY



APRIL 16, 1990

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Federal Emergency Management Agency

COMMUNITY NUMBER - **421708**

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Flood Insurance Study Effective Date: April 16, 1990

Flood Insurance Study Revised:

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	4
	2.4 Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
	3.1 Hydrologic Analyses	5
	3.2 Hydraulic Analyses	5
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	6
	4.1 Floodplain Boundaries	6
	4.2 Floodways	7
5.0	INSURANCE APPLICATIONS	7
6.0	FLOOD INSURANCE RATE MAP	9
7.0	OTHER STUDIES	10
8.0	LOCATION OF DATA	10
9.0	BIBLIOGRAPHY AND REFERENCES	10

TABLE OF CONTENTS - continued

Page

FIGURES

Figure 1 - Vicinity Map 3

Figure 2 - Floodway Schematic 8

TABLES

Table 1 - Summary of Discharges 5

EXHIBITS

Exhibit 1 - Flood Profiles
Crooked Creek Panels 01P

Exhibit 2 - Flood Insurance Rate Map Index and Street Index
Flood Insurance Rate Map

Exhibit 3 - Elevation Reference Marks

FLOOD INSURANCE STUDY
TOWNSHIP OF ARMSTRONG, INDIANA COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Armstrong, Indiana County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the Pittsburgh District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-86-E-2226, Project Order No. 2. This work was completed in April 1988.

1.3 Coordination

On May 31, 1985, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the Indiana County Planning Commission, and the COE (the study contractor) to determine the streams to be studied by detailed methods. Because township officials could not attend, study limits were determined with input from the Planning Commission.

On April 4, 1989, a final CCO meeting was held with representatives of FEMA, the township, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Armstrong, Indiana County, Pennsylvania. The Borough of Shelocta is not included in this study.. The area of study is shown on the Vicinity Map (Figure 1).

Crooked Creek was studied by detailed methods from the downstream corporate limits to the CSX Transportation bridge. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through April 1993.

Walker Run, Dark Hollow Run, Cheese Run, Anthony Run, Blacklegs Creek, Reeds Run, an unnamed tributary, and the remaining portion of Crooked Creek were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Township of Armstrong.

2.2 Community Description

The Township of Armstrong is located in the southwest portion of Indiana County in west-central Pennsylvania, approximately 3 miles west of the Borough of Indiana. It is bordered by the Township of Washington to the north, the Townships of Center and White to the east, the Townships of Young and Blacklick to the south, and the Townships of Plumcreek and South Bend to the west. Armstrong has a land area of approximately 36.6 square miles. The 1980 population of the township was 2,786, a 49 percent increase over the 1970 population of 1,867 (Reference 1).

Crooked Creek, with a total drainage area of 292 square miles, flows in a southwestern direction from its source in the Township of Rayne to its confluence with the Allegheny River at river mile 40. The average bed slope of Crooked Creek through the Township of Armstrong is approximately 5 feet per mile. Local relief above the stream varies from a low of 970 feet to an average hilltop elevation of 1,300 feet; the valley floor varies from 500 to 1,000 feet in width.

The climate for this area is temperate, with the usual seasonal variation in temperature. The area is located in a geographic region of variable air mass activity, subject to polar, tropical, continental and maritime air mass invasions. The weather is usually moderate, but is subject to frequent and rapid changes resulting from air mass movements. Temperatures range from highs around 90 degrees Fahrenheit (^{o}F) to lows below 0^{o}F, with an average of about 50^{o}F. Precipitation occurs mostly in the spring and summer months with an average annual precipitation of about 43 inches as measured by the National Weather Service precipitation gage at Creekside.

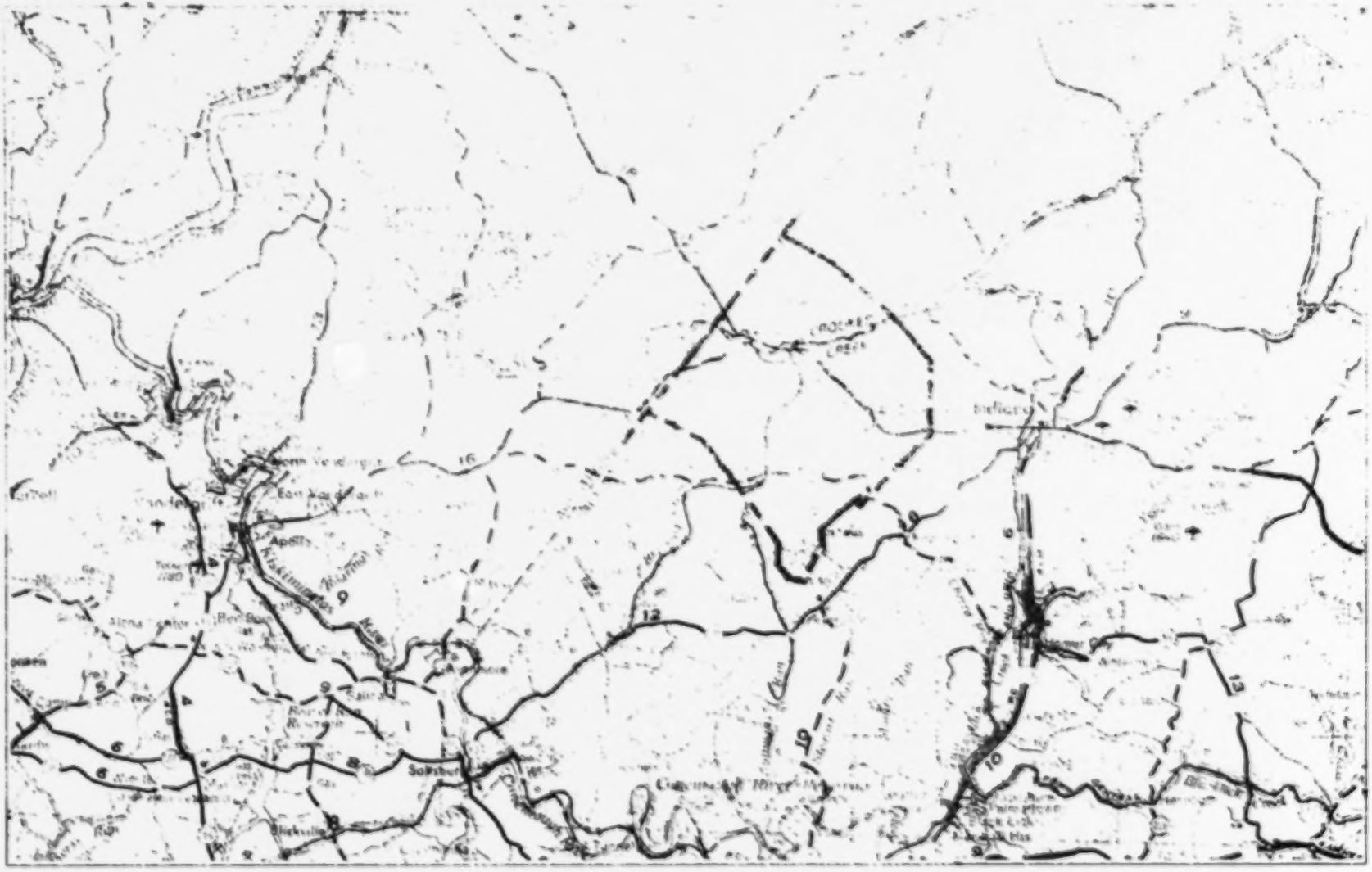


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF ARMSTRONG, PA

(INDIANA CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

2.3 Principal Flood Problems

Major floods may occur on Crooked Creek at various times of the year. Floods occurring in the winter months are usually the result of heavy rainfall and snowmelt. Floods occurring in the summer months are usually the result of high intensity, short duration storms.

The flood of record along Crooked Creek within the Township of Armstrong, based on estimates made from high-water marks, occurred in March 1936. Within the period of record for the U. S. Geological Survey (USGS) stream gage on Crooked Creek at Idaho, Pennsylvania (No. 03038000), the flood of record occurred in June 1972. The period of record for this gage is from 1937 to 1987; the gage's zero elevation is 961.04 feet. The following tabulation shows major floods on Crooked Creek as measured at the Idaho gage.

Date of Crest	Stage (feet)	Elevation (feet)	Discharge (cfs)
March 1936	18.60*	979.64*	19,400*
June 1972	15.93	976.97	13,200
October 1954	15.12	976.16	12,400
July 1977	13.38	974.42	8,860

*Estimated from high-water marks

2.4 Flood Protection Measures

There are no existing, authorized, or proposed flood control or related measures within or upstream of the Township of Armstrong that would reduce flood levels on Crooked Creek.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40

percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding source studied in detail affecting the community.

Natural flood frequency-discharge curves for Crooked Creek were developed by correlating data from recording gages located within the Crooked Creek drainage basin. The gages used in the analyses were the COE gage at Creekside and USGS gage No. 03038000 at Idaho. The relationships were analyzed following the log-Pearson Type III analysis outlined in USGS Bulletin 17B (Reference 2). A drainage area-versus-discharge relationship was then established for the basin. A comparison was made using the lower Allegheny River CSM relationship. The 100-year frequency flood was determined from this relationship.

A summary of the drainage area-peak discharge relationships for the stream studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGE (cfs) 100-YEAR
CROOKED CREEK		
At downstream corporate limits	109.0	12,470

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Estimates of the 100-year frequency flood elevations on Crooked Creek within the Township of Armstrong were developed through the use of past floods from which high-water marks, gaging station data, and discharge values are available and applicable to present stream conditions.

The well-defined floods of July 20, 1977, September 14, 1972, February 24, 1975, and the moderate flow of December 14, 1973 were selected. The water-surface elevations versus corresponding discharge for each of the historical flood events were plotted on logarithmic paper at key rating points along the stream. Rating locations were chosen at points where the channel gradient changed significantly. Flood profiles were drawn using the extrapolate 100-year water-surface elevation at each of the selected rating locations.

All frequency profiles were derived on the assumption that stable channels are maintained and that vegetative effects do not modify the roughness characteristics markedly. Similarly, no allowance was made for any effects from ice jams or debris.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 1).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For the stream studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 3).

For the streams studied by approximate methods, the floodplain boundaries were delineated using the Flood Hazard Boundary Map for the Township of Armstrong (Reference 4).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards

(Zones A and AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

No floodways were calculated as part of this study.

5.0 INSURANCE APPLICATIONS

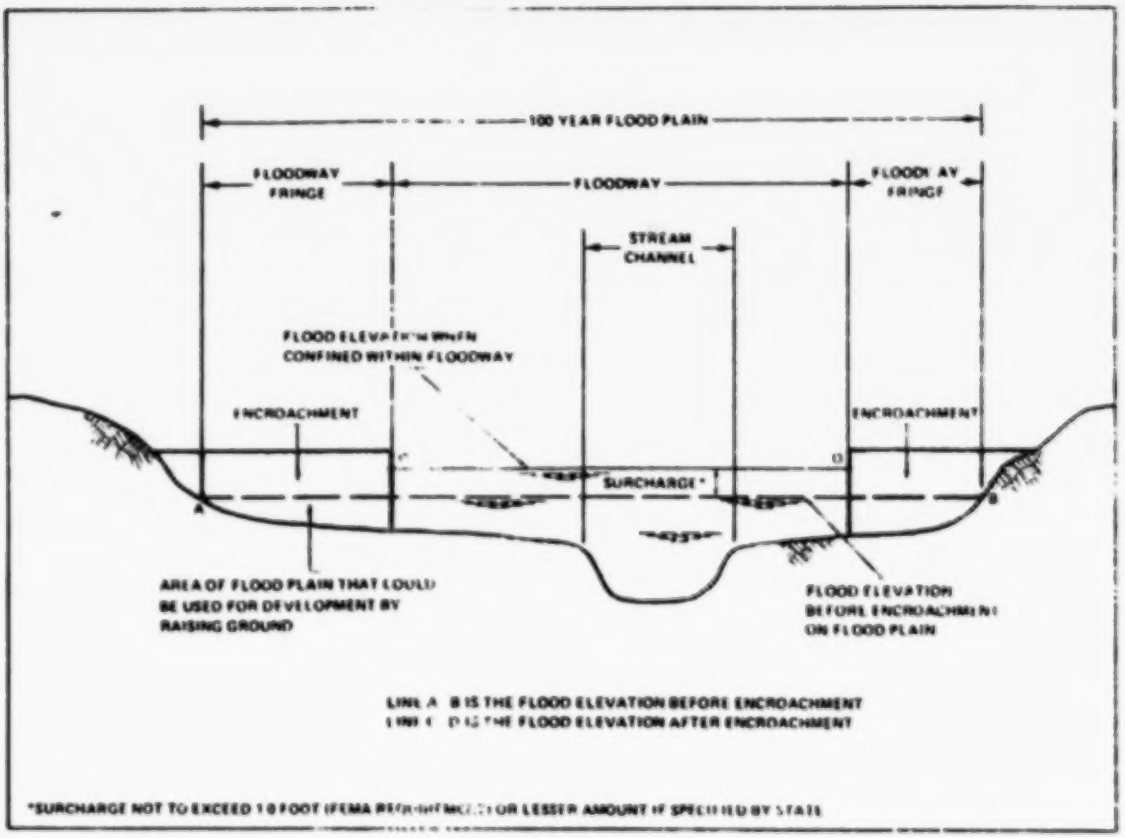
For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
SURCHARGE*
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 2

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

7.0 OTHER STUDIES

Flood Insurance Studies are currently being prepared for the Borough of Shelocta and the Township of Washington (References 5 and 6). The results of those studies will be in agreement with the results of this study.

Due to its more detailed nature, this study supersedes the Flood Hazard Boundary Map for the Township of Armstrong (Reference 4).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Pennsylvania, Washington, D. C., U. S. Government Printing Office, 1981.

2. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

3. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Elderton, Pennsylvania, 1964, Photorevised 1973.

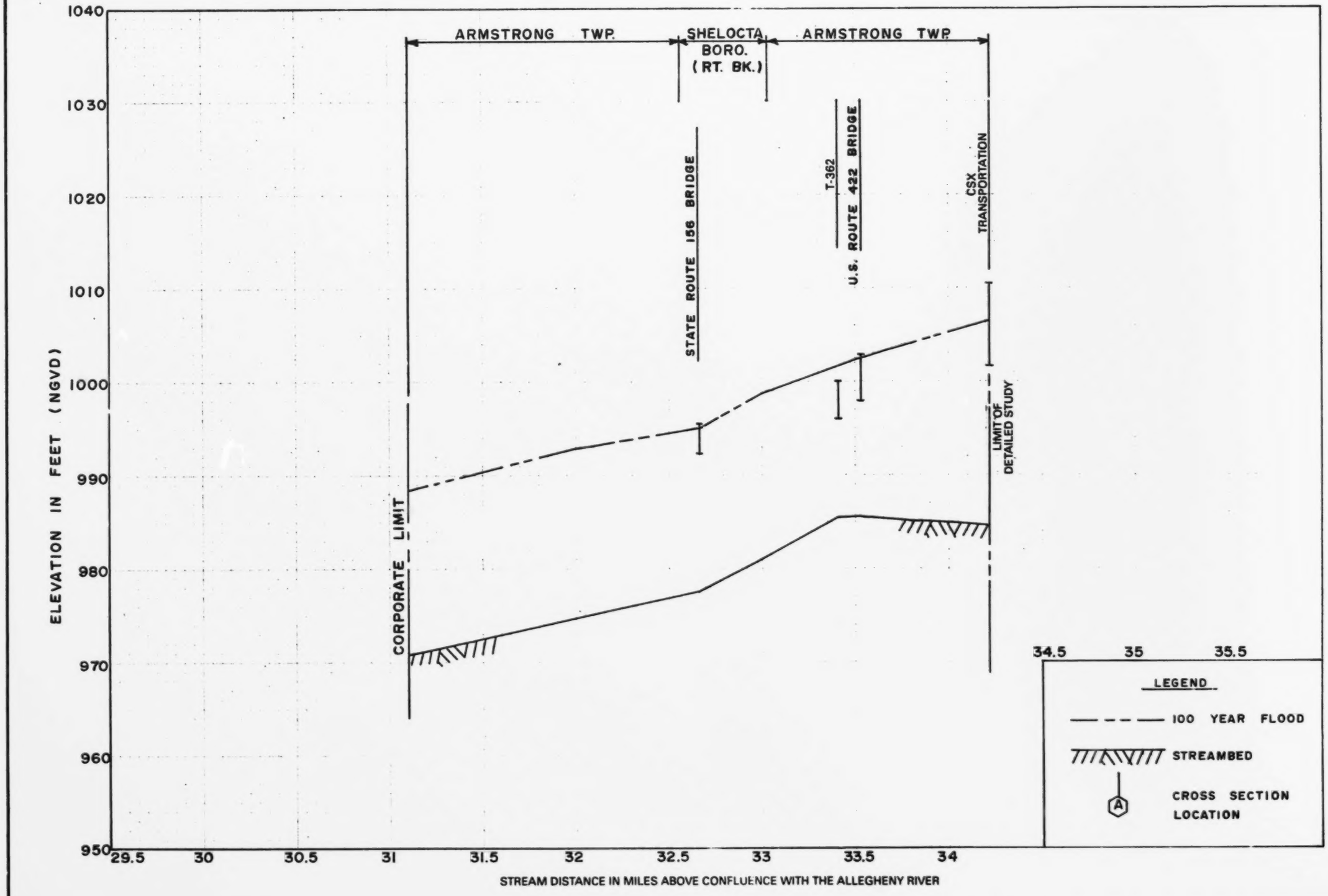
4. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Township of Armstrong, Indiana County, Pennsylvania, December 6, 1974.

5. Federal Emergency Management Agency, Flood Insurance Study, Borough of Shelocta, Indiana County, Pennsylvania (Unpublished).

6. Federal Emergency Management Agency, Flood Insurance Study, Township of Washington, Indiana County, Pennsylvania (Unpublished).

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	04	976.91	U cut on top of upstream side concrete railing, approximately 60 feet from upstream right bank end of State Route 156 bridge over Crooked Creek at Borough of Shelocta.
RM 2	04	999.23	L cut on top of corner of upstream right bank concrete wing wall of access road bridge over Crooked Creek.
RM 3	04	1009.58	L cut on top of upstream left bank wing wall of CSX Transportation bridge over Crooked Creek.



FLOOD PROFILES

CROOKED CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF ARMSTRONG, PA

(INDIANA COUNTY)

01P